DISCHARGE DESTINATION FOLLOWING HIP FRACTURE IN CANADA AMONG PREVIOUSLY COMMUNITY-DWELLING OLDER ADULTS, 2004-2012: DATABASE STUDY

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ABSTRACT

Purpose: To examine discharge destinations by provinces in Canada, adjusting for patient, injury, and care characteristics.

Methods: We analyzed population-based hospital discharge abstracts from a national administrative database for community-dwelling patients who underwent hip fracture surgery between 2004 and 2012 in Canada. Discharge destination was categorized as rehabilitation, home, acute care, and continuing care. Multinomial logistic regression modelling compared proportions of discharge to rehabilitation, acute care, and continuing care versus home between each province and Ontario. Adjusted risk differences and risk ratios were estimated.

Results: Of 111,952 previously community-dwelling patients aged 65 years or older, 22.5% were discharged to rehabilitation, 31.6% to home, 27.0% to acute care, and 18.2% to continuing care, with significant variation across provinces ($p<0.001$). The proportion of discharge to rehabilitation ranged from 2.4% in British Columbia to 41.0% in Ontario while the proportion discharged home ranged from 20.3% in Prince Edward Island to 52.2% in British Columbia. The proportion of discharge to acute care ranged from 15.2% in Ontario to 58.8% in Saskatchewan while the proportion discharged to continuing care ranged from 9.3% in Manitoba and Prince Edward Island to 22.9% in New Brunswick. Adjusting for hospital type changed the direction of the provincial effect on discharge to continuing care in two provinces, but statistical significance remained consistent with the primary analysis.

Conclusions: Discharge destination from the surgical hospital after hip fracture is highly variable across 9 Canadian provinces. Further work is required to determine the impact of this heterogeneity on patient outcomes and health system costs.

MINI ABSTRACT

Little is known about post-acute care following hip fracture surgery. We investigated discharge destinations from surgical hospitals for 9 Canadian provinces. We identified significant heterogeneity in discharge patterns across provinces suggesting different post-acute recovery pathways. Further work is required to determine the impact on patient outcomes and health system costs.

KEYWORDS

Hip fracture, health services research, discharge destination, variation.

INTRODUCTION

Hip fractures are significant injuries that typically occur in seniors; the incidence of hip fracture is increasing with our aging population [1-3]. In addition to the substantial risk of mortality and morbidity faced by patients after a hip fracture [4-6], healthcare costs are also considerable [7,8]. In 2005, patients with hip fractures made up only 15% of overall osteoporotic fractures in the USA, but represented 72% of the costs associated with the care of patients with osteoporotic fracture [9]. To date, much of the interventional research to improve patient outcomes after hip fracture has focused on acute care management strategies such as time to surgery [10,11].

Recovery after hip fracture is prolonged extending over at least the first year, well beyond the care delivered in the surgical hospital setting [12-14]. There is growing recognition that care delivery in the post-acute period, including where patients are discharged to after the surgical hospital stay, is under-studied and whose impact on patient recovery and health services utilization is unclear [15-25]. We hypothesized that, in Canada, hospital type (teaching versus community) might affect discharge decision-making with teaching hospitals more likely to send

patients to other sites for further recovery (i.e., rehabilitation or acute care) due to surgical bed demands and availability of community-based care. Unlike the USA, the use of post-acute rehabilitation or skilled nursing facilities is uncommon in Canada [26]. Dis-coordinated discharge decision-making is, at least, in part due to current payment policies where providers across different settings are not incentivized to coordinate care [27,28]. Instead care providers work in their respective treatment silos where payment is given for setting-specific services [29]. This may lead to inefficient use of health resources where total episode of care length of stay increases or avoidable readmissions occur [30]. In Ontario, Pitzul et al. (2016) identified 49 unique post-discharge pathways utilized following hip fracture with significant regional and hospital variation [31]. Although inpatient rehabilitation was associated with higher initial costs, patients who were discharged to the community were more likely to be re-admitted or die within one-year of hip fracture than patients discharged to inpatient rehabilitation [32]. Others have reported similar findings in both the USA and internationally; rehabilitation may be associated with increased costs, but often leads to improved patient outcomes [19,33-35].

Thus, data are lacking on how discharge destination varies after discharge from the surgical hospital following hip fracture surgery. Knowledge of variability in discharge practices can inform future policy on post-acute care pathways to enhance patient recovery while utilizing constrained health resources efficiently. The objective of this study was to determine, among previously community-dwelling patients surgically treated for first hip fracture in Canada (excluding Quebec): 1) the proportion of discharge destinations in each province; 2) the standardized difference in discharge destinations between each province and Ontario, adjusting for patient, injury, and care characteristics; and 3) the role of hospital type in inter-provincial differences in discharge destinations. We hypothesized that there would be significant variation

in discharge destinations after hip fracture across provinces, even after risk adjustment and that this variation would be mitigated by hospital type.

METHODS

Study and patient setting

We examined discharge abstracts of 121,507 previously community-dwelling patients 65 years or older who underwent surgery for non-pathological first hip fracture between January 1, 2004 and December 31, 2012 in Canadian hospitals, except for the province of Quebec. Quebec compiles hospital discharge data in a separate database and does not contribute to the CIHI Discharge Abstracts Database. We focused on those who received surgery as only a small number (n=5,396 [4.4%]) did not receive surgical intervention (See Supplementary Tables for discharge destination of non-operative patients). Abstracts were selected from the Discharge Abstract Database maintained by the Canadian Institute for Health Information (CIHI) using procedure codes for hip fracture surgery (CCI: 1VA74^^, 1VA53^^, 1VC74^^, 1SQ53^^, or CCP: 9054, 9114, 9134, 9351, 9359, 9361, 9362, 9363, 9364, 9369). Multiple abstracts with the same patient identifier were combined into one care episode using the CIHI rules for hospital transfers [36,37]. We considered patients to have been previously community-dwelling if they were admitted from home or home with support services. Admissions from acute care, ambulatory care or the emergency department were also considered proxies for previously community-dwelling patients as these settings are not pre-admission residences. In provinces with larger rural populations, patients were frequently initially admitted to non-surgical hospitals and then discharged and admitted to a surgical hospital, which could be several hours later due to transfer time. These were not considered as ‘preoperative transfers’, but rather ‘admissions from acute care settings’ [36,37]. Patients were not considered community-dwelling if they were admitted from continuing care (i.e., long-term residential care), which included rehabilitation

facilities, chronic care facilities and nursing homes. From our initial cohort of 121,507 potentially eligible patients, we excluded 7,716 patients who died in hospital after hip fracture and 1,839 patients who underwent surgery in a hospital with an annual surgical volume of less than 24 surgeries [38]. This resulted in an analytical cohort of 111,952 community-dwelling patients who were surgically treated for first hip fracture.

Outcome

The outcome was discharge destination from the surgical hospital, categorized as rehabilitation, home, acute care, continuing care, and other. CIHI 'discharge disposition' codes were used to identify discharges to home (discharged home or discharged to home setting with support services), acute care (transferred to another facility providing inpatient hospital care), continuing care (transferred to another facility or level of care other than acute), and other (transferred to palliative care or a hospice, signed out against medical advice, or did not return from pass). CIHI 'institution to type' codes indicating transfer to a general or special rehabilitation facility were used to capture discharges to rehabilitation. CIHI re-abstraction shows high reliability for both 'discharge disposition' and 'institution to type' data elements that were used to characterize the outcome [39]. We estimated the proportion of patients who were discharged to each destination in the overall study population and by province. Due to the small number of patients discharged to other, we did not report the effect of province on this outcome category.

Study variable

The province where surgery was performed was the primary study variable. We coded the available provinces as: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, and Saskatchewan. Ontario was the

reference province as nearly half of all patients underwent surgery in that province (47.4%). The secondary study variable was hospital type at surgery: teaching hospital, large community hospital, or medium community hospital. CIHI classifies non-teaching community hospitals based on the yearly volume of inpatient cases, total weighted cases, and inpatient days[40]. Community hospitals are classified as large if they meet two of the following three criteria: more than 8,000 inpatient cases; more than 10,000 weighted cases; more than 50,000 inpatient days. Community hospitals are classified as medium if they have a volume of 2,000 weighted cases or more.

Statistical analysis

We reported frequencies and percentages of patient characteristics, the type of fracture, and care delivery across provinces.

The proportion of discharge to rehabilitation, home, acute care, and continuing care was estimated by dividing the number of discharges to each destination by the number of total discharges in the overall population or in a given province. We used Pearson's Chi-square test of independence to compare the distribution of discharge destinations across provinces. We used a multinomial logistic regression model to test the difference in proportions of discharge to rehabilitation, acute care, continuing care versus home between the provinces and Ontario. We adjusted for age (<85 years or 85 years and older), sex, comorbidity (none or at least one) [16,41], fracture type (transcervical or trochanteric), timing of admission (early weekday, late weekday, or weekend), preoperative transfer history (none or at least one hospital transfer occurring between the date of initial hospitalization and date of hip fracture surgery) [36], preoperative procedures (none or at least one procedure before hip fracture surgery not related to a medical reason for delay) [42], hospital volume (above or below median number of hip fracture

surgeries at the treating hospital during the fiscal year when the patient was admitted), excessive surgical demand (excessive demand defined as the number of admissions for hip fracture in the week of initial hospitalization exceeding the hospital weekly capacity for surgery), surgery type (internal fixation or implantation/other), timing of surgery (day of admission, admission day 2, admission day 3, admission day 4, or after 4 days), and by calendar year of admission. Standard errors of the regression coefficients were estimated by relaxing the independence assumption between patients within hospitals. Based on regression analysis, we estimated absolute risk differences and risk ratios of discharge destination for each province compared to Ontario, standardizing the distribution of patient, injury, and care characteristics to that of Ontario [43].

In secondary analysis, we additionally adjusted for hospital type at surgery in our multinomial logistic regression model to determine if provincial variation would persist. Stata release 15 was used for statistical analyses [44].

RESULTS

Patient characteristics

Most patients were women (73.7%) and were less than 85 years old (59.8%) (Table 1). More than half of patients were admitted for transcervical hip fracture (52.8%) and a quarter of patients had at least one comorbidity (25.0%). Most patients underwent internal fixation (59.8%), underwent surgery at a large community hospital (44.9%), were treated on inpatient day 2 (42.2%), and did not experience a pre-operative transfer (91.0%). Alberta and Saskatchewan exhibited the largest proportion of surgeries at a teaching hospital (73.4% and 91.9% respectively).

Discharge destination overall and by province

Overall, 22.5% of patients were discharged to rehabilitation, 31.6% to home, 27.0% to acute care, 18.2% to continuing care, and 0.8% to other (Table 2). These proportions varied significantly across provinces (X^2=33284.2, df=32, p<0.001) (Figure 1). Ontario most frequently discharged patients to rehabilitation (41.0%). Discharge to home was most prevalent in British Columbia (52.2%), Nova Scotia (47.6%), Newfoundland and Labrador (46.9%), and New Brunswick (37.8%). Most patients were commonly discharged to acute care in Saskatchewan (58.8%), Alberta (58.2%), Prince Edward Island (52.3%), and Manitoba (37.0%).

Discharge to rehabilitation

The proportion of discharge to rehabilitation ranged from 2.4% in British Columbia to 41.0% in Ontario (Figure 1). Compared to Ontario, the standardized proportion of discharge to rehabilitation was significantly lower in all provinces, with the greatest differences in British Columbia (difference = -39.9%; 95% CI -46.0, -33.8), Alberta (difference = -39.2; 95% CI -45.3, -33.2), Saskatchewan (difference = -38.2; 95% CI -44.9, -31.4), Nova Scotia (difference = -38.1; 95% CI -46.0, -30.1), New Brunswick (difference = -36.5; 95% CI -44.6, -28.4), and Newfoundland and Labrador (difference = -32.1; 95% CI -41.2, -23.0) (Table 3). Statistical significance was consistent between risk differences and risk ratios.

Discharge to home

The proportion of discharge to home ranged from 20.3% in Prince Edward Island to 52.2% in British Columbia (Figure 1). Compared to Ontario, the proportion of discharge to home was higher in British Columbia (difference = 32.2%; 95% CI 23.2, 41.3), Nova Scotia (difference = 23.8%; 95% CI 6.6, 41.0), Newfoundland and Labrador (difference = 22.9%; 95% CI 15.8, 30.0), New Brunswick (difference = 14.7%; 95% CI 6.7, 22.7), and Manitoba (difference =

11.6%; 95% CI 4.8, 18.4), and was significantly lower in Prince Edward Island (difference = -4.0%; 95% CI -7.1, -1.0) (Table 3). Statistical significance was consistent between risk differences and risk ratios.

Discharge to acute care

The proportion of discharge to acute care ranged from 15.2% in Ontario to 58.8% in Saskatchewan (Figure 1). Compared to Ontario, the proportion of discharge to acute care after standardization was higher in Saskatchewan (difference = 47.4%; 95% CI 34.6, 60.1), Alberta (difference = 47.0%; 95% CI 40.9, 53.0), Prince Edward Island (difference = 42.4%; 95% CI 38.4, 46.3), Manitoba (difference = 22.4%; 95% CI 7.8, 37.0), New Brunswick (difference = 21.9%; 95% CI 13.1, 30.7), Nova Scotia (difference = 21.1%; 95% CI 3.1, 39.1), and Newfoundland and Labrador (difference = 17.7%; 95% CI 12.7, 22.8) (Table 3). Statistical significance was consistent between risk differences and risk ratios.

Discharge to continuing care

The proportion of discharge to continuing care ranged from 9.3% in Manitoba to 22.9% in New Brunswick (Figure 1). Compared to Ontario, the standardized proportion of discharge to continuing care was lower in Prince Edward Island (difference = -12.8%; 95% CI -15.1, -10.5), Alberta (difference = -12.2%; 95% CI -15.2, -9.2), Manitoba (difference = -12.1%; 95% CI -14.9, -9.3), Newfoundland and Labrador (difference = -9.8%; 95% CI -12.8, -6.8), Saskatchewan (difference = -9.4%; 95% CI -15.5, -3.3), and Nova Scotia (difference = -6.6%; 95% CI -11.6, -1.7) (Table 3). Statistical significance was consistent between risk differences and risk ratios.

Discharge destination by province, accounting for hospital type

After adjusting for hospital type, the direction of the provincial effect on discharge to continuing care changed in British Columbia and New Brunswick (Table 4). The statistical significance of all provincial effects on discharge destination remained consistent with the primary analysis.

DISCUSSION

We found significant variation in discharge destinations from the surgical hospital after hip fracture in Canada even after standardizing patient, injury, and care characteristics. Discharge to rehabilitation accounted for less than 6% of patient discharges in five provinces. Within these five provinces, discharge destinations were commonly directly to home or transfers to other acute care facilities. Discharges from the surgical hospital to continuing care, which typically indicates a transition from the community to permanent residential care, was also heterogeneous, varying from as low as 9.3% to as high as 22.9%. Based on our previous work, where care and outcomes of hip fracture patients varied by hospital type (e.g. length of stay and mortality),[45,46] we hypothesized that accounting for teaching versus community hospital would mitigate provincial variation, but hospital type appeared to have little impact on differences in discharge destinations. This may suggest that discharge destination is resource driven (i.e., availability of beds or rehabilitation access) rather than driven by clinical personnel decision-making or hospital status.

Pitzul et al.'s recent work raises concern regarding our findings as patients in Ontario who received post-acute inpatient rehabilitation had lower mortality and re-admissions within the first year after hip fracture than those who were discharged directly to the community [32]. A recent systematic review also identified that both patient and facility factors lead to increased readmissions after hip fracture [30]. International reports support improved patient outcomes

from discharge to rehabilitation facilities, but at a higher direct cost than discharge to home [15,19,33,35,47].

In Canada, inpatient rehabilitation facilities for patients with hip fractures are very limited outside of Ontario. In a direct comparison of Canada and the USA using clinical trial data, the acute care length of stay of stay was higher in Canada with significantly less use of inpatient rehabilitation; however mortality up to three-years after hip fracture was significantly lower in Canada [26]. These findings appear contrary to those reported in within-country comparisons, suggesting that further work is required regarding both treatment settings and services provided during the recovery period.

Rehabilitation may also be offered in acute care facilities that are not designated as rehabilitation facilities, or via home care, but it is likely that rehabilitation intensity is lower due to more limited rehabilitation resources relative to rehabilitation facilities. Indeed, a recent national UK audit of rehabilitation after hip fracture surgery reported wait times of up to 3 months for rehabilitation at home following discharge from acute care [48]. If rehabilitation is beneficial to patient outcomes, approaches to deliver timely higher intensity rehabilitation in settings other than formal rehabilitation facilities should be developed as infra-structure for multiple new rehabilitation facilities is likely not feasible for most health care systems.

Other Canadian work evaluating total joint arthroplasty and stroke patient populations reported that post-acute service variation led to substantial differences in health care costs due to longer length of stays and higher re-admissions [27,29]. Similarly, studies in the USA have also identified substantial variation in post-acute care with resultant differences in both costs and outcomes [18,19,23,33]. Clearly, further evaluation of post-acute care is needed to determine

how best to develop and organize post-acute care to maximize patient outcomes while using resources efficiently.

Although this is the first study to evaluate discharge destinations using a national evaluation approach in Canada, there are some limitations. Based on data available, we can describe discharge patterns, but not the patient outcomes associated with these care patterns. We also did not attempt to separate secular trends in care from provincial variation in discharge practices. Canada has provincial physician and hospital-based insurance programs that independently organize patient care, payments and data reporting, limiting our ability to determine the impact of inter-provincial service variation and organizational changes that might have occurred over time.

We also only followed patients for their initial hospital stay, so are unable to determine how discharge practices affected patients' ability to ultimately return to live in the community. Data from rehabilitation settings following surgical hospital discharge are not in the national hospital discharge database, so we could not compare overall lengths of stays in facilities after a hip fracture. Non-mandatory data reporting in rehabilitation facilities or reporting of rehabilitation intensity in hospital settings in Canada substantially limits our ability to understand the association between rehabilitation intensity and duration relative to patient outcomes and health service utilization. We excluded patients who underwent surgery in a hospital with an annual volume of <24 surgeries. This led to the exclusion of small community hospitals from our analysis. Therefore, results may not be generalizable to patients undergoing surgery at these sites.

Finally, we classified patients admitted from acute, emergency, or ambulatory care as previously community-dwelling, which may have led to some misclassification. We made this decision to

capture an additional 25,814 patients in the analysis (Table 2 vs. Supplementary Table 2). In particular, we substantially increased the proportion of patients included in the analysis from provinces with large rural populations where patients may take longer to move from a non-surgical hospital to a surgical hospital and thus, are considered as admissions from acute care rather than transfers. We believe the potential for misclassification is low as patients admitted from continuing care are likely to return to continuing care after their hospital stay [49].We conducted a series of sensitivity analyses and noted a similar proportion of patients discharged to continuing care among those who were admitted from home or home with support, acute, emergency, or ambulatory care, and those who were admitted from home or home with support. (Supplementary Tables 1-3). We also examined the discharge status of the small proportion (<5%) of patients who did not receive surgical management in our sensitivity analysis, which also demonstrated similar heterogeneity in discharge patterns (Supplementary Table 4).

This work is foundational as the first to examine discharge patterns following hip fracture across Canada to increase our understanding of the national variation in post-acute recovery pathways. This baseline knowledge will facilitate further evaluations and comparisons across and within provinces and or countries to determine which pathways are most effective and cost-effective. We demonstrated that there are currently no broadly standardized pathways in provinces' post-acute care delivery with marked heterogeneity in discharge decision-making, similar to that noted in other countries [19,23,33,34]. Further evaluations in various post-acute treatment settings (i.e., rehabilitation, acute care or home) as well as by rehabilitation intensity (e.g. frequency, duration) and services provided would facilitate evaluation of the impact of various post-discharge pathways on patient outcomes and health system costs.

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CONFLICTS OF INTEREST

The following competing interests are declared: (1) LB is the David Magee Endowed Chair in Musculoskeletal Research supported by the Faculty of Rehabilitation Medicine at the University of Alberta. (2) PG has received grants from the Canadian Institutes of Health Research related to this work. PG also receives funding from the Natural Sciences and Engineering Research Council of Canada, the Canadian Foundation for Innovation and the British Columbia Specialists Services Committee for work around hip fracture care not related to this manuscript. He has also received fees from the BC Specialists Services Committee (for a provincial quality improvement project on redesign of hip fracture care) and from Stryker Orthopedics (as a product development consultant). He is a board member and shareholder in Traumis Surgical Systems Inc. and a board

member for the Canadian Orthopedic Foundation. He also serves on the speakers' bureaus of AO Trauma North America and Stryker Canada. (3) SNM reports research grants from Amgen Canada and from Merck. (4) BS, JDK, LK, KJS, JMS, and EH declare they have no conflicts of interest.

FIGURE CAPTION

Fig 1. Percentage of patients discharged by destination across the Canadian provinces. Discharge destination represented by shade, percentage represented by the length of bars. Provinces are in ascending order of percentage for discharge to rehabilitation. Percentage of patients discharged to destination other than rehabilitation, home, acute care, or continuing care not shown (transferred to palliative care or hospice, signed out against medical advice, or did not return from pass). Abbreviations: AB=Alberta; BC=British Columbia; MB=Manitoba; NB=New Brunswick; NL=Newfoundland and Labrador; NS=Nova Scotia; ON=Ontario; PE= Prince Edward Island; SK=Saskatchewan.

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